Radar-Based Hazard Alerting And The Evolving Telematics Scene

Before You Buy A Radar Detector, You've Got To Read This...

by Alan Dixon, N3HOE/WPUC72Ø/KST8678

Time really flies in the world of cutting-edge technical developments, and this is especially true in the world of *telematics*. It's been nearly a year since we've seen an article on telematics here in the pages of *Pop'Comm*, and several years since we've taken a look at radar-based hazard alerting technology and speed radar countermeasures.

Remember what telematics is? "Telematics" is a fairly new, and now universally accepted, term used to describe all of the collective electronics systems in motor vehicles involving communication, navigation, and artificial intelligence.

The Safety Warning System

I first examined the radar spectrum-based Safety Warning System (SWS) in the July 2002 issue of *Pop'Comm*, in "On-The-Go Radio," back when I was producing that column (which is now in the very capable hands of veteran columnist Jock Elliott). So much has developed in the realm of radar detectors and associated safety alerting receivers since that time, however! As it turned out, shortly after that column was written in early 2002, four major developments in this field have occurred: one, perhaps the most recent, appears to be market-related; two are technological evolutions; and the third is the result of a regulatory development that at first looked to be bad, but has turned out to be a blessing of sorts, in disguise.

First, though, let's review the traffic speed radar and laser lidar (light detection and ranging) bands. If you already own, or if you have been shopping for, a radar detector, then you already know that there are *three* microwave bands currently in use for police traffic radar. These are, in order of their evolution, the original X band, followed by the Kq or Kl band (which became more simply known as K band), and more recently, the Ka band (see **Table 1**).

This may be just a bit confusing, since the Ka band is a subset of the broader K band. Nonetheless, if a radar detector manufacturer claims that the unit covers the X and K bands only, you should presume that it would *not* cover the Ka band. While this may seem deceptive, it is simply a matter of convention that has developed over time. As it turns out, back when the FCC authorized the Kq band in addition to the original X band, no one could have foreseen that another portion of the K band would eventually be authorized for police radar in the future. If this had been anticipated, the Kq band would no doubt have been specifically labeled as such.

One good choice is one of the Cobra Electronics XRS 9700 series radar/laser and Safety Alert telematics receivers. This unit offers radar and laser speed detection alerts on all bands, POP-mode "undetectability" detection, and alerting of both VG-2 and Spectre I Radar Detector-Detectors—all in addition to Safety Alert message reception. (Photo courtesy of N3HOE.)

SWS: What It Is And Does

Here's a quick overview at what SWS technology is and what it does. As originally noted way back in that July 2002 article, it was SWS functionality that ushered radar detectors full scale toward the telematics concept. An SWS receiver is truly both an artificial intelligence device and a digital communications receiver.

This system was designed to give specific advisory messages to motorists by means of four-bit binary codes sent by SWS transmitters, up to a total of 64 possible messages. A microprocessor in most late model radar detectors can receive the Frequency Shift Keying (FSK) digital message and use a ROM

Table 1. Radar Bands

BAND	FREQUENCIES
X Band	10.525 GHz ±25 MHz
K_q or K_l Band (K Band)	24.150 GHz ±100 MHz
K_a Band	33.4-36.0 GHz
Safety Warning System	24.100 ±25 MHz (6.002 MHz occupied bandwidth)
Safety Alert	24.070, 24.110, 24.190 , 24.230 GHz
Strobe Alert	300-770 THz
Laser	300-375 THz (910 nm ±50 nm wavelength)
LTI 20-20	300-375 THz
ProLaser	300-375 THz
Ultralyte Laser	300-375 THz
VG-2 RDD	11.4-11.7 GHz
Spectre Mark I & II RDD	~11-15 GHz
Spectre Mark III RDD	~10-25 GHz

MHz = Megahertz
GHz = Gigahertz
THz = Terahertz
nm = Nanometer

database lookup table to translate the message into either text or synthesized speech emulation for a spoken alert to the driver. Some radar detectors built in recent years use RISC (an acronym for reduced instruction set computer) chips, the same microprocessors that have been used in professional-grade UNIX computer workstations.

The really good news was that the SWS had a measure of backward compatibility with older Kq band ("K" band) radar detectors not equipped for SWS operation. While these non-SWS detectors would not provide any specific text or spoken SWS alerts, they would nevertheless activate in the normal fashion, bringing the driver's attention to some sort of road hazard nearby. SWS has been probably the most inexpensive upgrade to digital telematics that a motorist could make. In fact, to this day, even if you have a newer vehicle with a factory-equipped embedded telematics system, you probably don't have SWS functionality or any similar radar spectrum-based warning system.

There is, and has been for some time however, one notable competing radar-based telematics technology on the market as well. Cobra Electronics Corporation's proprietary Safety Alert Traffic Warning System also transmits emergency warning messages to radar-based receivers for a graphic, text, or voice presentation, much as SWS does (see **Table 2**). There are substantial differences between these two systems, though. While both technologies operate in the Kq speed radar band, actual signaling methods differ. But, the Safety Alert System (SAS) is not a new development. It has been on the market for several years now.

According to Cobra product literature, SAS transmitters send various alert messages that are distinguished by the *frequency* of the signal emitted. This stands in stark contrast to the previously mentioned SWS's binary code signaling method. In any case, all such Safety Alert signals fall within the standard Kq traffic radar band. This in-band signaling enables all conventional radar detectors with Kq band coverage to receive these warning signals as standard radar alerts. Here again, the SAS affords valuable backward compatibility with earlier Kq band radar detectors not already SAS operation-enabled. While these non-Safety Alert detectors are obviously not capable of providing any graphic or spoken Safety Alerts, they would still activate in the conventional manner, bringing the driver's attention, again, to the possibility of a potential road hazard in the vicinity.

SAS Vs. SWS: Your Choice?

The SAS offers only three alert messages to motorists, however. SAS designers clearly had something elegantly simple in mind in engineering their technology. Rather than numerous text signals with specific messages, SAS keeps drivers' eyes on the road by acknowledging a hazardous situation within proximity and giving a simple graphic, such as two words of text and a simple audio alert like a horn sound or a high/low siren.

Depending upon receiver design, graphics could also be shown as a trumpet horn icon, a railroad crossing "X" sign icon, or the universal ball-bat (exclamation point) in a triangle alert icon. These graphics and sound bites are easily and effortlessly learned by drivers so as to be instantly recognized with minimal, if any, distraction from the road ahead. Compare this with having to read and mentally digest a line of scrolling text, "Road Closed Ahead/Follow Detour." As a consumer and motorist, you ought to have your choice among the two still-new technologies here: flawless simplicity or specific sophistication.

Growing Pains?

But not every fledgling technology that sees the light of day is guaranteed to succeed in the marketplace. So, how is the SWS concept doing in the marketplace after several years? Apparently, not all that well. The SWS SafetyRadar website is now defunct, as is the Safety Warning System, LLC, site. And the radar detector manufacturers we contacted in following up on SWS were entirely mum on the technology.

So, *if* present observations are correct and *if* no other corporation or organization picks up the SWS "ball" and runs with it, that technology *could* become a dying thing over the next several years. Those concerned with this more recent market-related development should watch the radar detector and telematics sector carefully.

In any case, availability and, therefore, the almost inevitable proliferation of Safety Alert transmitters and receivers appears to continue apace, being a viable, marketable technology. So, in choosing a radar detector for its telematics alerting functionality, which system should you opt for? I don't pretend to see into the future, particularly when the present situation is so murky, so I can't answer that question for you. But, in selecting an

Table 2. Safety Alert Warning Messages

Emergency Vehicle	(In Motion)
Train Approaching	(Crossing)
Road Hazard	(Stationary)
***	(Reserved)

Here's an entirely different telematics device. If not restricted in your state or locality, or if you have a license for it, consider a mobile scanner. This new NASCAR-licensed Uniden BC-350C has one-button service-searches for police, fire, EMS, air, marine, weather, and even CB radio bands from 30 to 512 MHz, and can be user-programmed with up to 100 individual 800-MHz channels or any other available frequencies. For telematics use, the Fire/EMS, police, and CB service searches can locate street and highway accidents and tie-ups on the road ahead. (Photo courtesy of N3HOE)

upgraded radar detector for my own personal use, I can tell you that I did in fact give up my SWS detector for a Safety Alert-enabled model. That was my personal choice, but there are a couple of other very significant factors to consider when choosing a radar detector, and my own selection considered numerous aspects carefully.

These factors concern the two technological developments coming to light here in *Pop'Comm* since our aforementioned telematics radar detector article was written. One is the advent of higher technology detectors that can sense the new police radar guns using something called "POP" technology.

MPH Industries has been manufacturing its Bee III radar since 1999, with its main advantage over other police radar apparatus being its reputed undetectability by radar detectors on the market up to that time and in the years immediately following. This has been accomplished by a transmitted pulse of as little as ~67 milliseconds (ms). The problem for radar detectors is that most, and quite possibly all, had receiver gate times of about 200 to 300 ms. Taking into consideration the fact that popular design radar detectors sweep (scan) a large chunk of spectrum in the given band (Ka) we can easily see that the probability of a detector intercepting and recognizing the incident signal is minimal.

How Good , Or Bad, Are Detectors?

Using such short burst times can cause problems with overall accuracy, though. Depending upon how it's applied, this sort of short-burst technology could at best result in a limited number of tightly dispersed tracking intervals over what is an extremely limited sampling period. Such an isolated timing sample or a short, rapid set of samples in an instant of time cannot likely establish a tracking timeline of *statistical significance*, and for what it is worth forensically, *effectively* ignores acceleration and deceleration factors.

The radar transceiver (gun) must be absolutely stationary during the burst duty cycle, or if it were to be used in a moving configuration, the sustained speeds of both the transceiver and the target—even for mere milliseconds—would have to be clocked with laboratory-grade accuracy, factoring in any acceleration or deceleration, at least on the part of the transceiver station.

Not surprisingly then, industry reports tell us that POP-mode is not expected to stand up in court. The manufacturer, MPH Industries, recommends that officers get a "tracking history" of alleged speed violators by operating the radar transceiver in the conventional mode after using POP-mode to determine that a given vehicle is in fact speeding. MPH acknowledges that this is because most speed radar case law is based on tracking a vehicle by standard, accepted radar operation. So, while MPH Industries asserts that readings obtained in POP-mode are "accurate and reliable," they concede that such tracking may not be upheld in court under case law scrutiny.

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New Detectors: They "See" POP-Mode Signals

The related development of interest then is a new generation of radar detectors that can now "see" POP-mode signals and will appropriately alarm drivers. POP-mode detection is not a feature offered on all new detectors, but you can look for this valuable protection in the more expensive radar detector products. You may get away with your negligent speeding on a citation based only on a POP-mode observation, but do you really want to bet a hefty fine and even costlier penalty points on it? If I happen to become careless, I would rather take an alert as the friendly reminder that it ought to be: to watch my speed and to adjust it appropriately.

The other technological development of note here is closely intertwined with the one regulatory development to be discussed in this article. This basically comes down to radar detector *undetectability*.

VG-2: The Cops Are "Listening," Too!

For some years, the "godfather" of radar detector-detectors, the venerable Interceptor VG-2, has used leakage from motorists' radar detectors Intermediate Frequency (IF)-stage local oscillators to sense the presence of any nearby detectors. Technisonic Industries, Ltd., had years earlier developed their pioneering prototype radar detector-detector (RDD) unit, identified as the VG-1 for testing purposes (the mysterious letters "V" and "G" turn out to be initials of the engineers who designed the product). After some early testing with Canada's Ontario Provincial Police had been concluded, a production model, known as the VG-2, was made available to law enforcement agencies.

It wasn't too many years after the introduction of the VG-2, however, that radar detector manufacturers added a similar feature in subsequent products that detected the presence of the VG-2 itself in exactly the same manner: by detecting IF-stage local oscillator leakage! These newer radar detectors would then instantly and automatically shut down their own local oscillators and alert drivers to the imminent threat. Subsequently, radar detector designers added supplementary countermeasures by using nonstandard IF frequencies (that is, other than ~11.55 GHz) or by using sweeping local oscillators, constantly changing the IF frequency.

Scan Our Web Site

But, contrary to what you may have read by Internet bloggers, the VG-2 is still in limited production for particular jurisdictions and is used primarily to find radar detectors at close range, in prohibited commercial vehicles.

Forget About VG-3—It Doesn't Exist

Given this, you still need a radar detector offering protection from the VG-2. So, what about an updated VG-3 version? Here again, contrary to certain Web postings, possibly originating from unscrupulous sources' claims, there never was a VG-3. And Technisonic tells *Pop'Comm* that, in essence, there are no plans to design or manufacture any newer RDD products.

Then, just a few years back, a relatively new Australian company called Stealth Microsystems Pty., Ltd., introduced its renamed Stalcar radar detector-detector into the United States under its North American name, Spectre RDD. In early testing, the Spectre prototypes reputedly detected "all" of the pre-FCC certification (see "The Need To Be "Invisible"—Again") radar detectors of that time. This was accomplished by sweeping a broad swath of spectrum in the 11- to 15-GHz range, looking for the now nonstandard IF frequencies of the newer radar detectors. To those of us with any amount of RF expertise, one solution to this detection problem is painfully obvious: RF-shield and isolate the local oscillator and, if practical, reduce IF power levels. Did no one ever think of this? The FCC eventually did.

Quite a number of gasoline service stations throughout the country use satellite Very Small Aperture Terminals (VSATs) to receive sales data from franchise and dealer national or regional offices. These VSAT downlinks operate in the 11.7- to 12.2-GHz frequency band, right where newer radar detector IF stages function. Since many service stations mount their VSAT antennas on the island canopies just above the fuel pumps, leaky detector local oscillators were on occasion causing interference to VSAT comms. When the FCC received complaints about this situation, action was unusually swift and certain.

The FCC's Part 15 Rules Come Into Play

In ET Docket 01-278, the FCC's First Report and Order (FCC 02-211) on very short notice required all radar detectors manufactured or imported into the United States after mid-2002 to be FCC-certificated under Part 15 rules. And this certification Order henceforth required that such new radar detectors be brought into compliance with already-established Part 15 radiated emission limits for unintentional radiators. (Existing radar detectors in use prior to that time remain unaffected by this new rule.) When this ruling was first proposed, some felt that it was a thinly disguised step toward outlawing radar detectors. But that was not the case. As it turned out, this regulatory development finally gave radar detector manufacturers a real incentive—indeed, a mandate—to clean up their dirty IF stages.

The Need To Be "Invisible"—Again

And cleaning up local oscillator leakage played right into the then-concurrent need to once again make detectors "invisible." The radar detector industry has responded with redesigned products offering substantial new immunity from detection, as well as a reduced probability of interfering with other communications.

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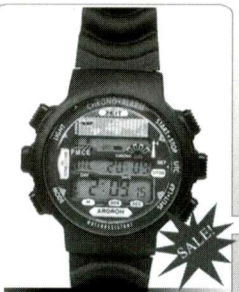

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The higher-end models may variously extend protection against the original Spectre Mark I RDD as well as the newer Spectre Mark II and Mark III series.

According to Stealth Microsystems, the first-generation Spectre RDD, the Mark I, was designed to sniff out pre-FCC certification radar detectors. That is, those detectors sold prior to mid-2002. The Mark II version was developed to combat the earlier FCC-certificated radar detectors, those sold sometime after mid-2002 (look for an FCC authorization number on the product).

A number of later model FCC-certificated radar detectors began using higher IF frequencies for Ka band conversion, from ~15 GHz up to near 24 GHz. And so the Mark III Spectre was developed to cover this expanded IF frequency range. Consequently, Stealth Microsystems claims that its Mark III Spectre finds "all models" of radar detectors FCC-certificated "to December 2004."

Check The Specs!

Check radar detector product specifications for any given model to get a feel for the level of security available against eavesdropping RDDs. (Note: If a radar detector claims Spectre III immunity or detection for example, do not *presume* that it will also be immune to, or will detect, Spectre I and/or II. Read specifications carefully.)

Also, when considering radar detector specifications, be sure not to confuse a detector's *immunity* (also called "invisibility" or "cloaking") characteristics with its RDD *detection* capabilities. For example, a radar detector that offers a Spectre I detection alert feature most likely will alert drivers to the presence of a Spectre I RDD, but may offer *no* protection against being discovered by that RDD; that is, unless this radar detector also offers Spectre I immunity from detection by a cloaking technology that renders it "invisible" to the subject RDD.

Radar detector equipment is now *approved* by the FCC (FCC 1st R&O 02-211), and radar detection with safety alerting receiver operation has been federally *endorsed* by the U.S. Department of Transportation since 1998 (TEA-21, P.L. 105-178) for private passenger vehicle use. Lawful, federally approved use of radar detector alerting receivers by private citizens clearly deserves communications security from overzealous eavesdropping state and local officials. Likewise, users of these federally approved devices also deserve protection from anti-radar detector statutes and ordinances that run counter to stated federal objectives.

Buying A Detector: What Should You Look For?

This brings us up to the point of getting to know what to look for in selecting a radar detector alerting receiver. With most products, it is customarily advisable to read any product reviews available prior to making a purchase. However in the case of radar detector telematics, you may do better by relying primarily on manufacturer specifications and claims.

There are several Websites, some well known, proffering product evaluations and consumer advice about radar detectors. Most are not worth the bandwidth they consume. I suppose that true scientific method assessment, with double-blind, controlled testing and peer review, is a bit much to ask of these side-by-side product comparisons. But I would expect at least reporting of results according to standard statistical practices, particularly in regard to establishing statistical significance, from any testing entity billing itself as a "laboratory." All such test reports that I've seen depended upon empirical testing.

Although it's tough to question such real-world results, you want to be wary of any such test reporting that makes overuse of superlatives and metaphors, and that overindulges in witty, sarcastic, or irrelevant remarks. And you've really got to wonder about testing and technical evaluations produced by racecar drivers with no engineering background evident.

If you are going to consider product reviews, look for testing conducted, tabulated, or supervised by an engineer who is FCC-licensed (since RF is federal jurisdiction) and is FCC-certified in radar. Avoid test reports littered with idle speculation. And look for assessments that you feel are impartial, if you can find them. Above all, when making your choice of a radar spectrum-based telematics device, carefully consider all of the aspects we have given you right here, as well as any other pertinent points you may discover in the process. Use your own good judgment and consider not only what the information you are collecting says, but also the various sources of your data. Stay safe, and enjoy motoring! ■

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